Active Project (2014 - 2018)

Kilopower Small Fission Technology (KP) Project

Game Changing Development Program | Space Technology Mission Directorate (STMD)

ANTICIPATED BENEFITS

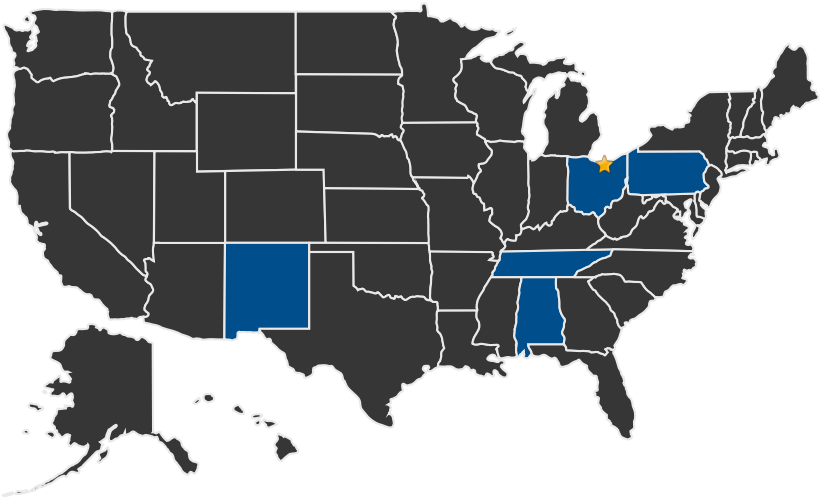
To NASA funded missions:

Reduces NASA dependence on Pu238 Enables SMD Decadal Survey Missions Provides Modular Option for HEOMD Mars Surface Missions.

DETAILED DESCRIPTION

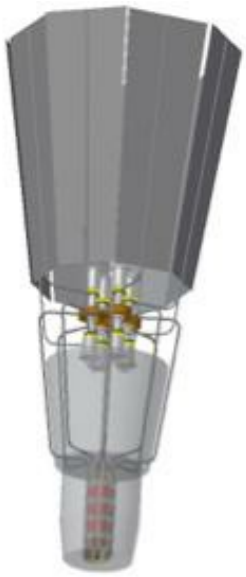
Previous space reactor development programs (e.g. SP-100, Prometheus) have failed to complete the all-important system-level demonstration. The Nuclear Systems Project will demonstrate fission power subsystem technology readiness in a relevant environment for two classes of NASA's mission requirements: 10-100's kWe for exploration outposts and nuclear electric propulsion via the Technology Demonstration Unit (TDU), and 1-10 kWe for robotic science and small exploration systems (Kilopower).

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center: Glenn Research Center



Kilopower Small Fission Power Systems

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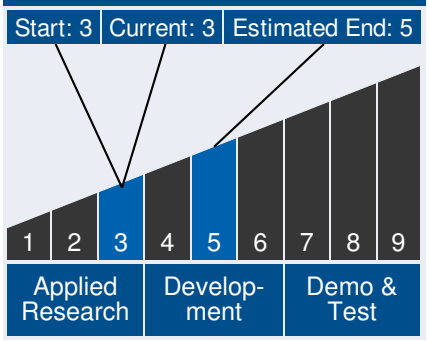

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Other Organizations Performing Work:

- Advanced Cooling Technologies, Inc. (Lancaster, PA)
- Department of Energy
- Sunpower, Inc. (Athens, OH)

Management Team

Program Executive:
- Lanetra Tate

Program Manager:
- Mary Wusk

Project Manager:
- Donald Palac

Principal Investigator:
- Charles Taylor

Technology Areas

Primary Technology Area:
Space Power and Energy Storage (TA 3)
└ Power Generation (TA 3.1)
  └ Fission (TA 3.1.5)
    └ 1-4 kWe Thermoelectric Fission Power System (TA 3.1.5.1)
    └ 1-10 kWe Stirling Fission Power System (TA 3.1.5.2)

Secondary Technology Area:
Space Power and Energy Storage (TA 3)
└ Power Generation (TA 3.1)
  └ Fission (TA 3.1.5)
    └ 1-4 kWe Thermoelectric Fission Power System (TA 3.1.5.1)

DETAILS FOR TECHNOLOGY 1

Technology Title

Kilopower Small Fission Power Systems

Technology Description

This technology is categorized as a hardware system for unmanned spaceflight

Nuclear power systems enable human and robotic exploration missions to solar system locations where other power system alternatives are infeasible, such as deep space or the dark and dusty surface of Mars. Currently, Radioisotope Power Systems fueled by Plutionium-238 can be used for missions needing a few hundred watts, and NASA is demonstrating the technology that would be needed for tens to hundreds of kilowatts for human outposts on planetary surfaces (see the Nuclear Systems Project in Techport). A gap exists in the 1-10 kilowatt regime for higher power science missions that would consume large portions of the world's limited Pu-238 supply, as well as for lower power elements of human exploration missions. A NASA/Department of Energy nuclear demonstration in 2012 at the Nevada National Security Site provided proof-of-principle benchtop validation that the technology needed for small fission power systems works, and can fill this gap. The Kilopower Small Fission Systems Project will advance this technology in three years to readiness for near term space missions by conducting a full-scale nuclear demonstration of a space-capable small fission power system in a relevant environment.

- Nuclear-heated test of prototype U235 reactor core coupled to flight-like Stirling convertors
- Detailed design concept that verifies scalability to 10 kWe
- Flight test of titanium-water heat pipe radiator on ISS to verify Zero-G performance

Capabilities Provided

- 1 to 10 kWe of power for solar system human and robotic exploration of locations where alternative power systema are infeasible
- Abundant power generation impervious to the environment

Potential Applications

- Deep space science missions:
  - Flybys
  - Orbiters
  - Landers
  - Rovers/subsurface exploration
- Human exploration missions: